

REMARKS

By this amendment, claim 1 is revised and arguments are submitted herewith to place this application in immediate condition for allowance. Currently, claims 1-4 are before the Examiner for consideration on their merits. Claims 5 and 8-10 are withdrawn as allegedly belonging to a non-elected species.

First, claim 1 is revised to correct a typographical error as noted by the Examiner in the last Office Action. Regardless of whether the Examiner is persuaded by the arguments below, this Amendment should be entered since it does not raise any new issues and puts the application in better form for appeal.

Turning now to the rejection, the Examiner newly rejects claims 1-4 based on 35 U.S.C. § 103(a) and United States Patent No. 6,607,381 to Minami et al. (Minami). First, the rejection is not clear in that it contends that Minami renders claim 1 obvious under 35 U.S.C. § 103(a), but the reasoning for the rejection appears to make a case for anticipation. More particularly, the Examiner identifies three components of Minami, the jig 1, the substrate 5, and the jig 2, and alleges that the jig 1 is silicon and comes into direct contact with substrate 5, and jig 2 holds jig 1. The Examiner then concludes that the first jig 1 is placed on the second jig 2 so that the first jig 1 is movable with respect to the surface of the second jig 2.

It is respectfully contended that Minami neither anticipates nor renders claim 1 obvious.

The invention addresses the problem of stress being applied to a semiconductor substrate during heat treatment when the substrate is held in a jig, whereby the stress can cause slips to occur.

Usually, when the heat treatment is performed in such a manner, supporting the peripheral portion of a large diameter substrate merely at three or four protruded positions that are disposed in the heat treatment boat, the central portion of the substrate deflects downward due to the heavy own

weight of the substrate. This phenomenon can cause slips to occur in the substrate.

If the back surface of the substrate is supported at numerous positions disposed over the entire back surface, or if a ring-like fixture is used for ensuring line contact or plane contact so as to increase the contact area between the jig and the back surface of the substrate, the deflection can be avoided. However, it is inevitable that the bonding of part of the back surface of the substrate and part of the holder takes place due to the high temperature, whereby the change in shape of the substrate and the holder is constrained and the stress incurred by such constraint exerted on the substrate means that the occurrence of slip is highly likely to occur.

The present invention solves this problem by supporting the substrate with two kinds of jigs, wherein the first jig directly contacts the substrate, and the second jig holds the first jig. This advancement is reflected in the language of claim 1 wherein it is stated that “a first jig that is constituted of a silicon material and comes into direct contact with the semiconductor substrate to support.” The second jig is defined as “a second jig (holder) that holds the first jig and is mounted on the heat treatment boat, wherein the first jig is placed on the second jig so that the first jig is movable relative to the second jig on the surface of the second jig.”

The heat treatment jig of claim 1 overcomes the problem of the prior art as explained above. That is, even if the back surface of the substrate should be partly bonded to the first jig, which it is in contact with due to high temperature during heat treatment, the substrate is still free to move without any constraint since the second jig holding the first jig and substrate are free to move. Put another way, the first jig, which is supporting the substrate, can move with respect to a surface of the second jig.

Since the force of constraint due to the holder (second jig) does not have any influence on the bonding region between the back surface of the substrate and the first jig, the occurrence of

slip, which normally would occur due to such a constraint force is avoided. Furthermore, since the first jig is made of silicon material which is the same as the semiconductor substrate, the strength of the first jig becomes equal to that of the substrate.

As a result of the features of the invention, it is less likely for the defects or damage to occur at contact portions between the back surface of the substrate and the first jig, and this results in prevention of the occurrence of slips.

Taking into account the features of the invention, the question regarding claim 1 is whether Minami either teaches all of the features of claim 1, and if not, whether Minami could be modified such that the features of claim 1 would be present.

As stated above, Minami cannot form the basis for a rejection under 35 U.S.C. § 102(b) since the features of claim 1 are not present, either implicitly or expressly.

Minami is directed to a heat-insulating jig for use in the vertical heat treatment apparatus for the purpose of heat treating wafers.

When silicon wafers are heat treated using the vertical heat treatment apparatus of Minami, the vertical wafer boat 4 for heat treatment on which the silicon wafers are mounted is inserted into the inside of the furnace cylinder of the heat treatment apparatus from the bottom with the shutter 3 being placed over the cylindrical thermal insulation jig 2, see Figure 47 and col. 9, lines 21-23.

The heat insulation jig 2 is disposed between the wafer boat and the shutter 3 for the purposes of preventing the heat inside the furnace cylinder from escaping through the bottom of the furnace cylinder due to thermal conduction, and preventing the deterioration or damage of sealant parts of the cap due to radiant heat. When the heat treatment is performed at high temperatures, the amount of heat that is generated inside the furnace cylinder becomes large, so

that the heat-insulating jig 2 having a larger thermal capacity is utilized.

However, when the heat treatment accompanying high speed heating and high speed lowering of temperatures, (high speed temperature control heat treatment) is performed using the vertical heat treatment apparatus, the large thermal capacity of the heat insulation jig 2 is, the slower the speeds of heating and lowering the temperature becomes. Therefore, the heat insulation jig 2 having a smaller thermal capacity is desirable. But when the thermal capacity of the heat insulation jig 2 is small, the heat inside the furnace cylinder easily escapes from the bottom of the furnace cylinder outwardly and the sealant parts of the shutter 3 or the like are liable to deteriorate or become damaged.

In this regard, Minami, for the purpose of being able to perform high speed temperature control heat treatment using a conventional heat treatment apparatus provides an auxiliary heating insulation jig 1. The auxiliary heat insulation jig 1 is situated between the heat insulation jig 2 and the wafer boat 4. The auxiliary heat insulation jig 1 is held by the heat insulation jig 2 and has an adiabatic effect, in order to shield the heat inside the furnace without accompanying the increase in thermal capacity.

Applicants' first argument is that Minami does not teach a jig that directly contacts the back surface of the semiconductor substrate. While the rejection makes this allegation, this is not supported when considering the teachings of Minami. The auxiliary jig 1 of Minami, alleged to be the same as the claimed first jig, is not configured to meet the limitation in claim 1 that the back surface of the semiconductor substrate directly contact the first jig. This is absolutely clear when viewing Figure 36 of Minami; there is no contact between the wafers and the jig 1. Lacking this feature of claim 1, the Examiner is incorrect in alleging that the Minami teaches a heat treatment jig that has a first jig that is in direct contact with the semiconductor substrate.

The rejection is also in error in contending that the second jig is present in Minami. In the rejection, the second jig is alleged to be the heat insulation jig 2. However, the heat insulation jig 2 of Minami does not meet the limitation that the “second jig (holder) that holds the first jig and is mounted on the heat treatment boat” found in claim 1. In Minami, the heat insulation jig 2 is cannot be considered to be “mounted on the heat treatment boat 4” by any stretch of the imagination.

Having demonstrated that at least two features of claim 1 are missing in Minami, this reference cannot establish a *prima facie* case of anticipation against claim 1.

The next question is whether there is a basis to support a rejection under 35 U.S.C. § 103(a) when considering the teachings of Minami. In order support such a rejection and given the fact that Minami does not teach a first jig that is in direct contact with the semiconductor substrate and a second jig supporting the first jig, the second jig being mounted to a heat treatment boat, the Examiner must have a reason for modifying Minami so as to allege that the invention is obvious.

Applicants submit that there is no reason to modify Minami and arrive at the invention. As explained above, the improvement sought by Minami is totally unrelated to the aim of the invention and reducing the occurrence of slips in the semiconductor substrate. Thus, there is no reason based on the teachings of Minami to alter the arrangement of the heat insulation jig 1 or the manner in which the heat insulation jig 2 is mounted. Without such reasoning, the Examiner does not have a basis to allege that Minami establishes a *prima facie* case of obviousness.

Any allegation of obviousness based on Minami can only be the reliance on hindsight to formulate a rejection under 35 U.S.C. § 103(a). Since the use of hindsight is prohibited as a basis to assert obviousness, such a rejection could not be sustained upon appeal.

Applicants note the Examiner's citation of JP 9-74071 (set out on page 5 of the action and referenced in Minami beginning on line 66 of col. 2.) While the formal recitation of the rejection only cites Minami under 35 U.S.C. § 103(a) as grounds for the rejection, it appears that the Examiner is also relying on this prior art to address one or more limitations in the claims. This reference is cited to allege that silicon carbide has been employed as part of a heat shielding jig. However, there is no reasoning regarding an issue of obviousness so the reliance on the Japanese publication is not understood and clarification of its use in the rejection is requested.

Regardless of the teachings of this prior art reference and how the Examiner may be relying on it, it has nothing to do with the patentability issue concerning Minami and it does not establish obviousness even if used with Minami.

In summary, Minami neither anticipates nor renders obvious claim 1, and the rejection as applied to this claim is improper and must be withdrawn. Dependent claims 2-4 are also in condition for allowance as a result of their dependency on claim 1.

On a final note, claims 5 and 8-10 stand withdrawn from consideration. Applicants submit that the restriction requirement should be withdrawn and that claims 5 and 8-10 should be passed onto issuance with allowable claims 1-4. First, claim 1 is generic to the material limitations recited in Claims 5 and 8-10, that merely further limit the first jig and the region contacting the semiconductor substrate. Since the material of the jig is not even at issue in deciding patentability, claims 5 and 8-10 should be included with claims 1-4 when this application is allowed.

Accordingly, the Examiner is requested to examine this application in light of this response and pass claims 1-5 and 8-10 onto issuance.

If the Examiner believes that an interview would be helpful in expediting the allowance

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of this application, the Examiner is requested to telephone the undersigned at 202-835-1753.

The above constitutes a complete response to all issues raised in the Office Action dated March 13, 2007.

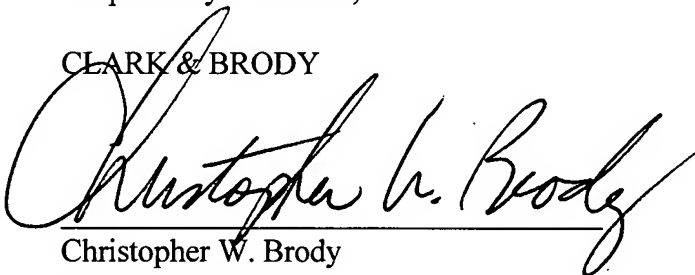
Again, reconsideration and allowance of this application is respectfully requested.

Please charge any fee deficiency to the same Deposit Account.

Respectfully submitted,

CLARK & BRODY

By

A handwritten signature in black ink, appearing to read "Christopher W. Brody", written over a horizontal line.

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